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Introduction

The use of tannin activity shows potential as a valuable chemical measurement in understanding red wine mouthfeel properties such as astringency and bitterness, which is also affected by tannin structural factors, in addition to matrix effects. However, most studies have used data sets where the variation between wines were high (because of cultivar or regional differences). Limited studies have investigated chemosensory studies to evaluate how structure-activity relationships change in a single varietal wine across multiple, consecutive vintages of a *single* producer.

Aims of study

The main aim of the present study was to investigate if and how tannin activity and concentration may be linked to red wine mouthfeel, by sensory analysis, and how additional variables may change according to vintage.

Experimental layout

The effect of wine vintage on tannin activity were investigated in red wine extracts isolated from 16 Pinotage wines (2003-2018) from a well-known producer using Sephadex LH-20 (by *flash column chromatography*).

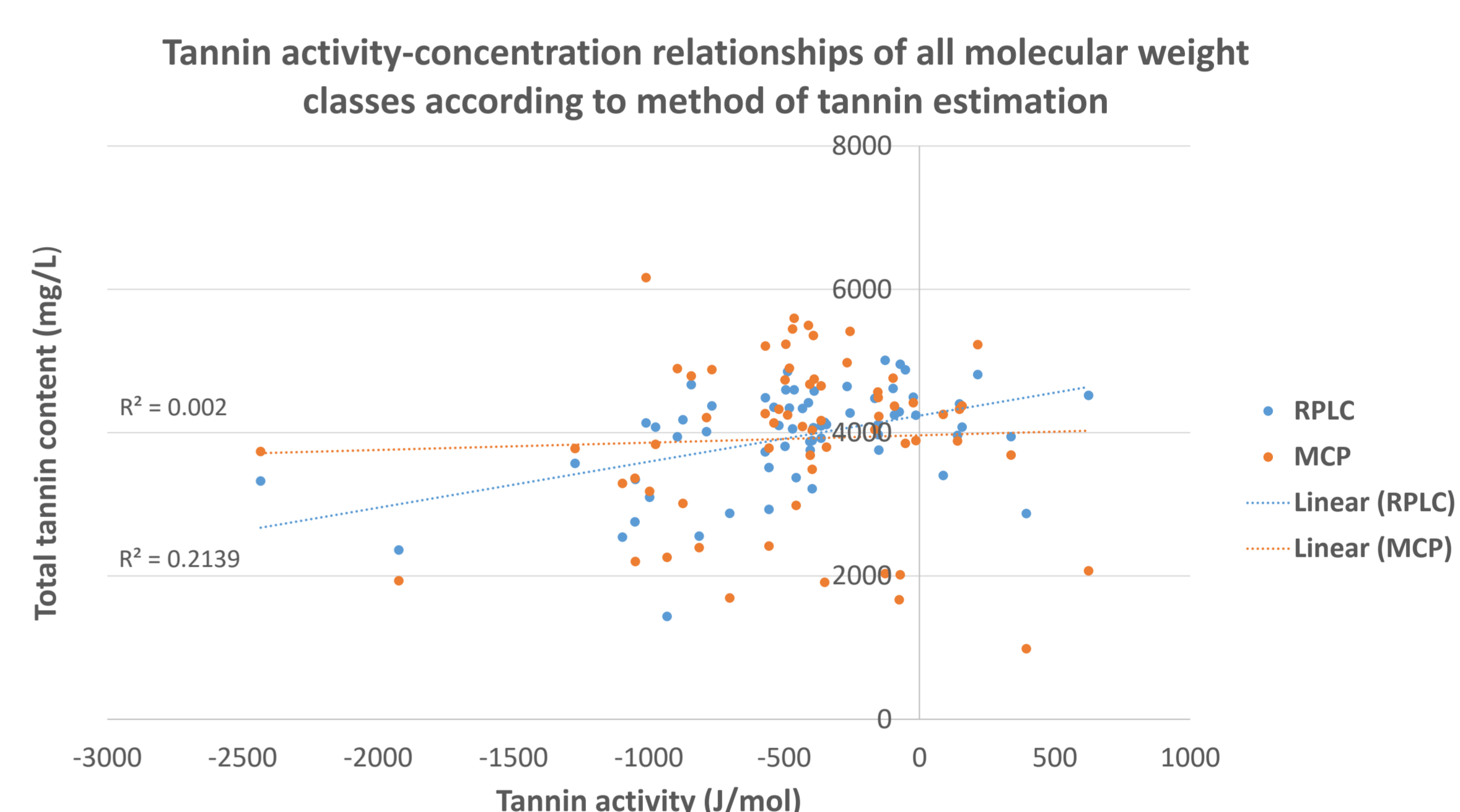
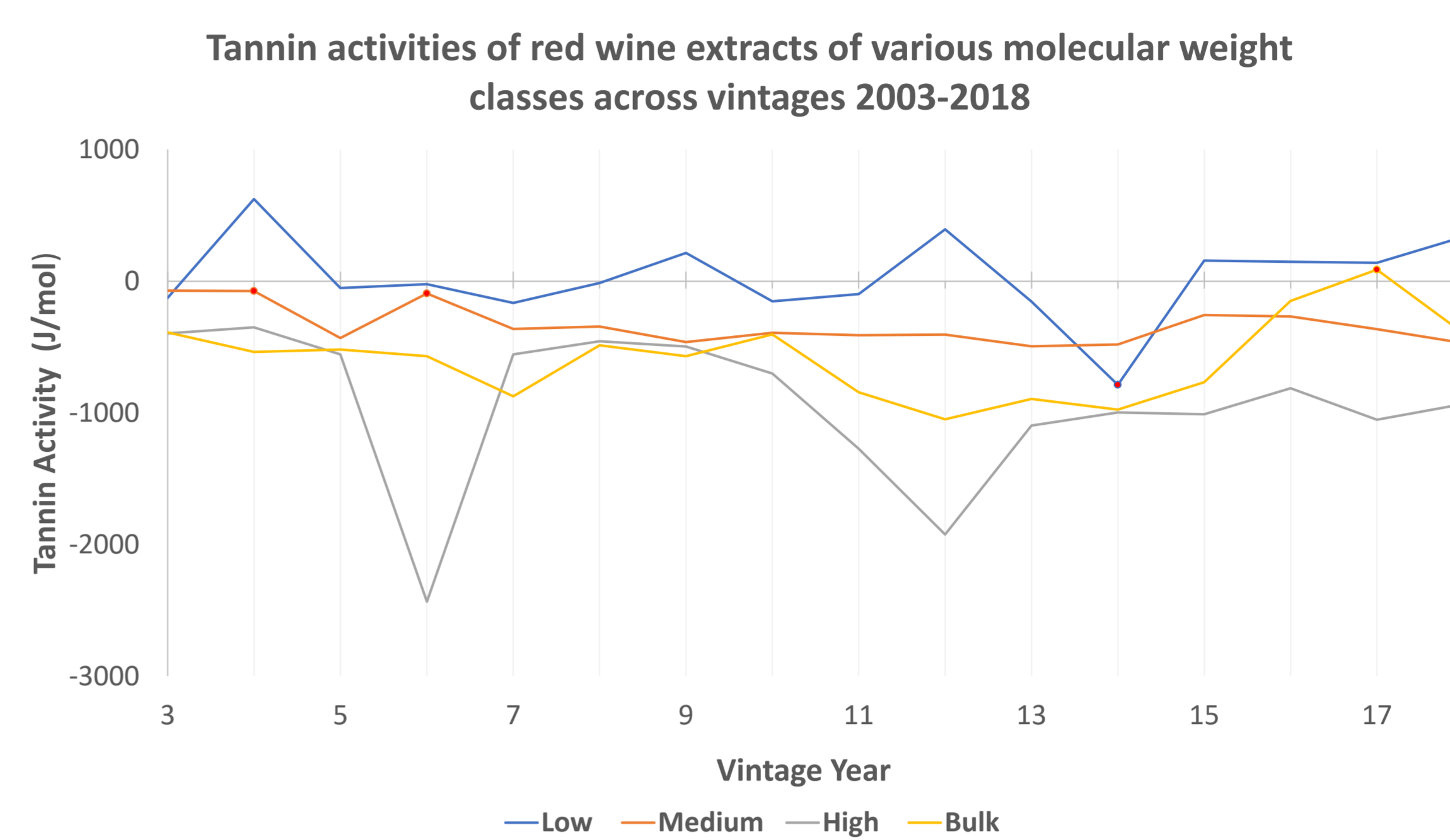
17-18 *lyophilized, polymeric* fractions were obtained across each vintage wine, and furtherly grouped into four subfractions of various classes: low, medium, high and bulk, giving 64 unique extract samples.

Pooled extracts were grouped in this way to obtain samples of variable but increasing molecular mass, which may each reflect differences in total phenolic and tannin content, *and* degree of polymerization.

Retention thermodynamics were used to calculate activity values by utilising reverse-phase liquid chromatography (RPLC) on a polystyrene divinylbenzene column. Individual samples were each analyzed at four different column temperatures (30-45°C), and van't Hoff plots were established to obtain tannin activity values from the slope of the curve.

Other complementary tannin-based techniques - were performed by obtaining chemical information primarily based on total tannin content (by MCP and RPLC), while sensory analyses was performed on the 2004-2018 vintages by an expert panel to evaluate seven mouthfeel attributes, namely fruitiness, sweetness, acidity, body, complexity, *astringency* and *bitterness*.

Results and Discussion



- The qualitative results in the first figure suggests that the affect of tannin activity showed a more pronounced difference across classes than according to vintage; on average, low molecular weight tannins had more positive, less negative values, suggesting a low tannin activity and therefore a low tendency to precipitate tannins and induce an astringency response.
- Tannin activity values became higher (more negative, *exothermic*) from low to high molecular weight classes, in agreement with literature which shows that highly polymerized tannins – towards a certain maximal value - have a greater propensity to bind to proteins, possessing higher tannin activity values, and therefore likely to induce the sensation of astringency
- Bulk wine fractions are representative fractions of all weight classes (*i.e. pooled aliquots of low, medium and high molecular weight classes within each vintage*); it was thought that these fractions would follow a trend where activity values would decrease as a function of vintage as wine ages. However, **no trends were observed here, as seen in the other weight classes**. These differences may be attributed to wine production practices and chemical changes as a function of wine age (*i.e. tannin oxidation*, and also due to the purification method used to purify tannins within this investigation).
- Additionally, in attempts to furtherly understand tannin structure-activity relationships, it was found that tannin activity was generally poorly correlated to concentration using either HPLC (chromatography) or MCP (spectrophotometry). This suggests that other interactions also play a role in modulating tannin activity, which include but are not limited to other structural factors such as size, composition or molecular conformation.
- Currently, sensory data will be incorporated in this study, in addition to other potential chemical analyses (such as phloroglucinolysis), to identify trends and establish links between *both* types of datasets via a chemosensory approach

Conclusion

Tannin activities trends were observed across molecular weight classes as opposed to wine vintages

These values generally showed poor correlations with tannin estimation techniques, which suggest that the role of other interactions should also be considered to astringency perception. The change of tannin activity in accordance with wine vintage was the primary aim within this study; the results show that additional work is needed to fully complement the data generated to obtain a better understanding, surrounding these changes

